



Update on Participating Load Functionality for Markets and Performance Initiative

Introduction

This document is an update to the California Independent System Operator's (ISO) October 30, 2008, Draft Final Proposal for Post-Release 1 MRTU Functionality for Demand Response,¹ to describe refinements in the functionality for demand response resources that is in the initial release of its Market Redesign and Technology Upgrade (MRTU) program. These refinements allow demand response (DR) resources to more fully integrate and participate in the ISO's markets and grid operations, and to add capacity to California's energy supply portfolio. The ISO's market design prior to MRTU includes opportunities for Loads to participate in the ISO's Real-Time (RT) Energy market, and to provide Non-Spinning Reserve – known as Participating Loads. The MRTU Release 1 software includes limited functionality to allow demand resources to participate directly in the ISO's wholesale markets. As part of the Markets and Performance (MAP) initiative, the ISO seeks not only to preserve these existing options, but also to add to their functionality by completing the functionality that was originally described in the MRTU program. The September 21, 2006, Federal Energy Regulatory Commission (FERC) Order on MRTU, as well as FERC Orders since then, directed the ISO to work with market participants to present additional opportunities for Demand Response resources to participate in the ISO Markets, and the ISO has done so as described herein.

The refinements to be implemented as part of the CAISO's Market and Performance (MAP) initiative provide a flexible model for Participating Loads that allows a single resource to both schedule demand and bid load curtailments as an integrated bid, which can use co-optimization of Energy and Ancillary Services in both the Day-Ahead and Real-Time Markets to determine the best utilization of the demand response resource. The refined functionality will effectively provide demand response resources with full comparable functionality to that of a generator in the ISO's markets. This design provides considerable flexibility for demand response resources, allowing Participating Loads to (1) simply bid into the ISO markets with a forward Energy Bid, (2) provide additional details about the operating characteristics of the demand response resource like Minimum Load Reduction (minimum MW of demand response), Minimum and Maximum Load Reduction Time, and Minimum Load Reduction Cost in addition to the Energy Bid, or (3) provide capacity for Residual Unit Commitment (RUC) and/or as Non-Spinning Reserve or other Ancillary Services (AS). This functionality will be implemented twelve

¹ The Draft Final Proposal for Post-Release 1 MRTU Functionality for Demand Response is available at <http://www.caiso.com/2070/2070c79e59140.pdf>. The Draft Final Proposal referred to the design described in this update as the Dispatchable Demand Resource (DDR) model, but the functionality described in the Draft Final Proposal is consistent with what the ISO had proposed as Participating Load in its original Conceptual Design Proposal.

California Independent System Operator

months after the start of operations under MRTU, and will replace the current and limited MRTU Participating Load functionality.²

This document describes details of the refined Participating Load functionality in two appendices: (1) Appendix A, which summarizes the Participating Load features of the original Market Design 2002 (MD02, later renamed to MRTU) Conceptual Design Proposal,³ and (2) Appendix B, which updates the ISO's "Draft Final Proposal for Post-Release 1 MRTU Functionality for Demand Response" and describes the features of the final design (following stakeholder discussion) in additional detail.⁴ Participating Load can be as simple or as robust as follows:

- At its most basic level, Participating Load is submitting a simple Energy Bid. This provides a way of "participating" in the ISO's market without requiring more complex resource parameters. A Participating Load that simply submits an Energy Bid is not very different from price-responsive Demand that bids as non-Participating Load. However, unlike non-participating Load, a Participating Load can bid into the Real-Time Market as well as the Day-Ahead Market, receive local LMP prices as compensation for Demand reductions when local areas are more congested than larger areas of the transmission system, and can set the Real-Time market price.
- Using additional, optional Bid components, a Participating Load can be a more robust resource and can choose, for example, to provide capacity for RUC or AS, or inform the ISO that its demand response resource has operational limits that the ISO must manage, including but not limited to:
 - Minimum Load Reduction and associated costs
 - Minimum and Maximum Load Reduction Times
 - Minimum time between load reductions
 - Minimum and Maximum Daily Energy Limits
 - Maximum number of daily load curtailments

These resource constraints provide equivalent features and characteristics that are recognized for generators, providing full comparability to generators. This model enables Participating Loads to supply all forms of Ancillary Services in the market (Non-Spinning Reserve, Spinning Reserve, and Regulation). The ISO's Participating Load design also accommodates end-use loads that have hourly or sub-hourly metering intervals. Additionally, bid cost recovery ensures resources that their market revenues will at least recover their bid costs.

² The MRTU functionality that is replaced is the Extended Non-Participating Load Model, which is described in the Business Practice Manual for Market Operations. In MRTU Release 1, Participating Loads are also eligible to use the Pumped-Storage Hydro Unit Model, which will still remain available. Future market design initiatives will not decrease, and may improve, the Release 1 functionality for pumped storage hydro generation, but such changes are beyond the scope of this document.

³ Appendix A was originally an appendix to the ISO's Issue Paper for Post-Release 1 MRTU Functionality for Demand Response.

⁴ The draft and final Straw Proposals and the Draft Final Proposal for Post-Release 1 MRTU Functionality for Demand Response, issued on October 30, 2008, included an appendix titled "Development of Software Requirements for Participating Load (Post-Release 1)", whose content has become part of the ISO's Business Requirements Specification that will guide the implementation of the Participating Load functionality. Because the content of this appendix has not changed from the October 2008 Draft Final Proposal, it is not repeated in this update.

California Independent System Operator

Background- Regulatory

The functionality described in this document was originally part of the MD02 Conceptual Design Proposal, which the ISO Board of Governors approved in April 2002 and the ISO filed with FERC on May 1, 2002, followed by ISO's filing of its proposed tariff revision on June 17, 2002. In its July 17, 2002, Order on the California Comprehensive Market Redesign Proposal, FERC agreed with the ISO that the demand side participation in markets is reasonable to include in its long-term market design. The ISO reiterated the proposed Participating Load functionality in its October 21, 2002, compliance filing to the July 2002 decision, and again included the proposed functionality in the July 2003 filing of the Amended Comprehensive Design Proposal, which the Board approved in June 2003. The July 2002 FERC Order on the California Comprehensive Market Redesign Proposal directed the ISO to enable the full participation of Participating Load in spinning reserve and other ancillary service markets. FERC's September 21, 2006, Order Conditionally Accepting the California Independent System Operator's Electric Tariff Filing to Reflect Market Redesign And Technology Upgrade, and April 20, 2007, Order Granting in Part and Denying in Part Requests for Clarification and Rehearing, directed the ISO to schedule and settle Participating Loads at their locations, rather than at the Default Load Aggregation Points. Further discussion of these aspects of scheduling and settlement for Participating Loads is at <http://www.caiso.com/2373/2373e027715d0.pdf>. The ISO's implementation of Participating Load functionality in the MAP initiative implements these FERC orders.

As the overall implementation of MRTU progressed, the ISO found it necessary to manage the scope of features that were implemented as Release 1, and deferred portions of the originally planned functionality for Participating Load. Through the MAP initiative, the planned functionality is now being completed.

Background- Stakeholder Process

In response to the FERC Orders and keen interest expressed by the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) in developing and integrating demand resources into the wholesale markets, the ISO, CPUC, and CEC formed five key demand resource working groups:

1. Demand Response Participation in MRTU Release 1 (Lead agency - ISO)
2. Demand Response Participation in MRTU Post Release 1 (Lead agency - ISO)⁵
3. Demand Resource Product Specification (Lead agency - CEC)
4. Infrastructure for Demand Resources (Lead agency - CEC)
5. Vision for Demand Resources (Lead agency - CPUC)

Each working group had specific objectives and resulting deliverables to produce, with the overarching objective being to enable greater participation from demand resources in the wholesale electricity markets. The ISO's Draft Final Proposal resulted from a collaborative effort by the Demand Response Participation in MRTU Post Release 1 Working Group (group 2), to develop details for completing the Participating Load functionality in MAP that was originally planned in MRTU.

The working group's activity supplemented the ISO's regular stakeholder process, which included the following steps:

- The ISO briefed stakeholders on the status of Participating Load functionality in MRTU Release 1, and the subsequent implementation of Dispatchable Demand Response (DDR)

⁵ The scope that has been outlined for Working Group 2 was: "Determine how demand resources will be modeled and fully integrated into the wholesale electricity markets and ISO grid operations. This could involve changes to the MRTU software and tariff."

California Independent System Operator

functionality, in a stakeholder meeting on November 2, 2006. The ISO's presentation is available at <http://www.aiso.com/18a1/18a1f35b1a600.pdf>, and an accompanying white paper is available at <http://www.aiso.com/18a3/18a3a45825570.pdf>.⁶

- The ISO initiated the working group by publishing an Issue Paper on "Post-Release 1 MRTU Functionality for Demand Response" on June 26, 2007 (see <http://www.aiso.com/1c08/1c0810a2e527b0.pdf>), and presenting it for discussion at a MRTU Release 1 demand response working group meeting on that date. The ISO's Issue Paper described the original vision for Participating Load functionality that was originally stated in the ISO's Market Design 2002 ("MD02") filings, but that could not be completed until after the initial implementation of Market Redesign and Technology Upgrade ("MRTU"). Feedback from stakeholders at that meeting indicated that there was interest in proceeding to develop the Participating Load functionality following the concepts that were described.
- The ISO published its Draft Straw Proposal (available at <http://www.aiso.com/1c64/1c64d4d07e40.pdf>) on September 25, 2007, a Revised Draft Straw Proposal that the ISO distributed to demand response working group participants on October 25, 2007, and its Straw Proposal that the ISO published (<http://www.aiso.com/1c91/1c919e0e11c30.pdf>) on November 9, 2007, based on written comments on those documents from working group participants and discussion at working group meetings on October 16 and November 5, 2007.
- The Straw Proposal was discussed at a stakeholder meeting on December 4, 2007, and a Market Surveillance Committee meeting on February 8, 2008.⁷
- Discussion continued at a working group meeting on June 12, 2008, and technical design sessions on July 30, August 8, and August 14, 2008, that guided funding applications to the California Public Utilities Commission.
- The ISO published its Draft Final Proposal on "Post-Release 1 MRTU Functionality for Demand Response" on October 30, 2008, which is available at <http://www.aiso.com/2070/2070c79e59140.pdf>. The Draft Final Proposal was discussed at a stakeholder meeting on November 5, 2008, for which the ISO's presentation is available at <http://www.aiso.com/2074/2074e67d2a600.pdf>.
- The ISO requested comments from stakeholders following each of the web postings of documents and following the stakeholder meetings.

To the extent that working group participants and stakeholders suggested enhancements to the ISO's initial Draft Straw Proposal, Revised Draft Straw Proposal, and final Straw Proposal that can be accommodated within the overall MAP design and within the ISO's obligations as a Balancing Authority, the ISO has incorporated them in the final design. The ISO has used the discussion in the demand response working group to add to the stakeholder process that began with discussion of the Issue Paper at the June 26, 2007, meeting. In the ISO's typical stakeholder process, the next step after the Issue Paper would have been publication of a Straw Proposal, but the ISO used additional stakeholder input through the working group to produce a more complete Straw Proposal. The ISO believes that the added discussion in the demand response working group has resulted in a more thorough consideration of stakeholder concerns

⁶ Other related materials from this workshop are available at <http://www.aiso.com/1cbb/1cbbc8ec52810.html>.

⁷ The timing of these steps has been affected by delays in the completion of MRTU implementation. However, in the meantime, the ISO has been able to proceed with some of its work on detailed design for implementing the proposal presented in this document.

California Independent System Operator

than would have occurred if the Straw Proposal had been produced directly after the Issue Paper.

The ISO will continue to use its stakeholder and working group processes to actively involve stakeholders in the development of tariff provisions, updates to Business Practice Manuals, and User Guide. Throughout the course of this project, the ISO will coordinate its development of all MAP features, and identify both (a) any interactions between Convergence Bidding and Participating Load, and (b) the role of demand response in Scarcity Pricing.

California Independent System Operator

Attachment A

Review of MD02 Conceptual Market Design for Demand Side Bidding and Options for Demand Response

The two sections of text in this attachment review the content of sections 5.8.2.2 and 5.8.3 of the ISO's April 29, 2002, Comprehensive Market Design Proposal for the Market Design 2002 Project (MD02), concerning "Accommodation of Demand Side Bidding" and "MRTU Options for Demand Response". Minor updates to the following description have been made to reflect changes in the overall MRTU design since the MD02 proposal was first submitted to FERC:

- References to FERC's Standard Market Design have been replaced with current references to MRTU's policy context, "MD02" has been replaced with "MRTU", references to sections of original MRTU Comprehensive Design Proposal have been replaced with references to this document, and the surrounding wording has been updated for the current context.
- Discussion of Available Capacity (ACAP) requirements has been deleted, because ACAP has been superseded with Resource Adequacy requirements.
- The Hour-Ahead Market, which was originally proposed in MD02, was later replaced by the Hour-Ahead Scheduling Process (HASP), which is part of the Real-Time Market (RTM). Participating Loads with sub-hourly metering will receive advisory dispatches and prices in HASP, and are then subject to dispatch in five-minute intervals in RTM. In order to accommodate the scheduling in RTM of Participating Loads that have only hourly interval metering, the ISO is replacing participation in the Hour-Ahead Market with bidding and scheduling in HASP, similar to non-dynamic intertie schedules.
- As required by FERC's September 21, 2006, Order conditionally accepting the ISO's MRTU tariff filing, MRTU Release 1 includes scheduling and settlement of Participating Load at its physical location, using custom load aggregation. The initial MD02 filing had offered options of scheduling at physical locations or at higher aggregations, and this was replaced in subsequent ISO filings with scheduling of base load at high-level aggregations and dispatch of the price-responsive Demand of Participating Loads at their physical location. Difficulties in reconciling these geographic levels for scheduling base load versus price responsive Demand led to the need to defer the full Participating Load functionality. FERC's requirement to schedule both the Demand and the demand response of Participating Load customers at the same, nodal level now allows the full price response to be allowed that was originally proposed.
- Market power mitigation is being considered through separate processes and thus is not described in this issue paper.

Because the described functionality was partially implemented during the initial Release 1 of the ISO's Market Redesign and Technology Upgrade (MRTU) program, the ISO anticipates that it will be able to complete the originally anticipated functionality for supporting demand resources, since MRTU's initial implementation is now complete.

California Independent System Operator

Accommodation of Demand Side Bidding

(Comprehensive Design Proposal, section 5.8.2.2)

The ISO's ongoing market design initiatives recognize that the development of demand resources is a significant part of a comprehensive market design. In general, the MRTU program has identified a number of features that will facilitate demand responsiveness once their implementation becomes feasible. A major piece of the Participating Load functionality in MAP will be to provide for voluntary three-part bids (equivalent to start-up and minimum-load costs, and energy bids) to be submitted to the Residual Unit Commitment (RUC) process as well as the Integrated Forward Market (IFM). This will ensure the most comparable treatment that can feasibly be provided between load and generation resources.⁸

The scheduling and settlement of load offers additional opportunities for response to day-ahead and hour-ahead energy prices. Because Participating Loads submit bids for dispatched "Participating Load" using custom load aggregations, loads can be price-responsive to locational prices through aggregated scheduling.⁹ If a LSE serves load that it believes will adjust its load based on forward energy prices, it can include an energy bid curve in its load schedule. Deviations from the resulting energy schedule would then be settled at the real-time energy price.

⁸ Examples can illustrate how equivalents of start-up and minimum-load costs promote comparable treatment of load and generation resources. If a load has a recovery time after a curtailment before it can be back in operation, which is independent of how long the curtailment lasts, it could bid a start-up cost equal to its energy bid price times that recovery time. A load that needs two hours to restart its industrial process after a curtailment ends, regardless of the length of curtailment, could thus be compensated for a minimum of its recovery cost given 0.5 hour of dispatched operation for a 30-minute curtailment, and for a minimum of its recovery cost given 4 hours of dispatched operation for a 4-hour curtailment.

As with a generator, its cost recovery would be for market revenues plus any net-of-market start-up and minimum-load cost. If the load is un-dispatched after one hour but its bid has a minimum 4 hours "run" time plus a "start-up" cost equal to 2 hours recovery time times its energy bid, it would also have a minimum cost recovery equivalent to 6 hours times its bid price. In this example, if its bid price is \$50/MWh plus its start-up cost and the market clearing price (MCP) from 1 to 2 PM is \$200 and \$40 from 2 PM to 5 PM, it would be assured of least \$300/MW of cost recovery (6 hours times \$50) but would have received \$320/MW in market revenue (1 hour at \$200, plus 3 hours at \$40), so it would receive no additional revenue to cover its "startup" cost. At a lower MCP, there may be assured cost recovery that would be charged to the market as an uplift. This is the same cost recovery as a CT that bid \$50/MWh, and has a 4 hour minimum run time and a \$100/MW startup cost.

The intent is to provide flexibility to loads in being dispatched in competition with other resources. In the above example, the load could bid a \$300/MW start-up cost, \$0 minimum load cost, and a \$0 energy bid that covers a 6-hour block time period, with the same result. The load could also use a minimum run time (i.e., minimum time off-line), instead of a fixed start-up cost, if it can perform its recovery during the curtailment and thus have a shorter recovery time after a longer dispatch. Alternatively, the load could bid a minimum-load cost per hour to curtail at all, and bid a different energy price for additional load shedding. Providing this flexibility to the LSE will be essential, and verification increasingly difficult for the ISO, in cases where the LSE uses an aggregation of load resources (e.g., air conditioning cycling on small end-use customers, combined with management of an industrial process) to support its bid.

In all the cases, the dispatch would have considered what is the most economical way of serving the overall energy need, and would dispatch the load resource if it were cheaper in total than other resources, including its startup and minimum-load cost. This will place a practical limit on loads bidding excessive start-up and minimum-load costs, since excessive bids could mean that the load resource would never be dispatched.

⁹ The minimum size for custom load aggregations will be 0.1 MW. Individual loads under 1 MW would be allowed to be aggregated as dispatchable load. Also, larger loads at the same bus may be aggregated, and justifications for aggregation of loads of 1 MW or more that are within local areas but on different buses (e.g., pumping loads within the same watershed or water delivery system) will be considered on a case-by-case basis.

California Independent System Operator

MRTU Options for Demand Response

(Comprehensive Design Proposal, section 5.8.3)

Although the ISO's MRTU program has evolved considerably since its original roots in FERC's Standard Market Design effort, a principle stated in FERC's March 2002 "Working Paper on Standardized Transmission Service and Wholesale Electric Market Design" (at p. 6) has not lost its significance: "Demand response is essential in competitive markets to assure the efficient interaction of supply and demand, as a check on supplier and locational market power, and as an opportunity for choice by wholesale and end-use customers." The ISO fully supports this role for demand resource programs.

The ISO's Market Redesign and Technology Upgrade (MRTU) proposals as stated herein further demonstrate the ISO's commitment to demand response programs as a vital ingredient for Load Serving Entities (LSEs) to meet their capacity obligation and meet their customers' needs. The implementation of retail demand programs is ultimately the responsibility of LSEs and state agencies, but the ISO is supporting these programs by establishing needed market infrastructure and incentives.¹⁰ When viewed in the context of a capacity obligation, the new ISO design including a capacity obligation will place additional financial incentives on LSEs to develop these programs to reduce their costs. The ISO's proposals also provide improved opportunities for load to respond to prices in the ISO's markets, and to participate as resources that augment supply resources. These opportunities include:

- Ability to recover "start-up" and "minimum-load" costs through Residual Unit Commitment.
- Day-Ahead energy market, allowing a commitment to load reduction at a price established with enough time to schedule daily production at an industrial facility (or similar planning for other loads). Viewed another way, a load can say through its bid that it will reduce its normal energy use if it would need to pay a higher-than-normal price – or that it will use additional energy if it is available at a lower-than-normal price. Currently, loads can deviate from their schedules and be paid as uninstructed deviations at real-time prices, but the real-time prices can be unpredictable from the customer's perspective. Thus, the new Day-Ahead market offers new opportunities for response at a known price.
- Participation in HASP allows Participating Loads with hourly metering intervals to offer price responsiveness when permitted by daily conditions, if curtailability is uncertain in the Day-Ahead timeframe. Participation in HASP improves a LSE's ability to operate its own load management programs, and to reflect this event through a revision to its scheduled load. Allowing schedule revisions closer to the operating hour will improve participating loads' ability to respond to both real-time system needs and their own operating needs.
- Participation in the Real-Time market, receiving the RT price with ability to be dispatched in competition with other resources like interties and CTs, assurance of recovering cost-based start-up costs and a minimum of its bid price for energy, and operation for a minimum run time.

¹⁰ For example, the end-use load can only get a benefit from the wholesale price if it is allowed by the CPUC (or the local regulatory authority). An end-use load under a bundled retail rate can then benefit from curtailing when the prices go up, or from using more energy when the prices go down, if the retail tariffs established by the CPUC provide an option for real-time pricing, which allows the IOU to pass through some type of charge or credit in addition to the bundled customer's retail rate.

California Independent System Operator

- Ability to receive the Real-Time price during the highest-cost intervals by a cycling response by 5-minute interval, for resources that can offer such response.
- Ability to offer response to locational price variations through DA and RT energy markets.
- Continued ability to participate in Ancillary Service markets, thus receiving a capacity price.
- Continuation of relaxed telemetry requirements for non-spinning reserve (one-minute updates from the participating load to the SC's server, as opposed to four-second updates from generators) and waiver of telemetry requirements for supplemental energy. That is, only interval metering and ability to receive dispatch instructions is necessary to supply supplemental energy, for individual and aggregated loads under 10 MW. For participation in the DA energy market, only the separate reporting of energy metering is needed, at the level at which the price response is offered, using metering requirements established by the Local Regulatory Authority.
- Loads or aggregated load entities must execute a Participating Load Agreement. This establishes sound mechanisms for settlement flows from the ISO to Scheduling Coordinators, which then allows settlement with LSEs and ultimately with end use loads.

California Independent System Operator

Attachment B

Design Principles for Participating Load Functionality in Markets and Performance Initiative

Background

The original MD02 conceptual design included a comprehensive Participating Load model, which included voluntary three-part bids similar to generators' start-up/ minimum-load cost/ multi-segment Energy Bid, Residual Unit Commitment (RUC) participation, Load aggregation, participation in multiple markets (Day-Ahead (DA) and Real-Time (RT)), eligibility to provide Non-Spinning Reserve, run-time constraints, etc.¹¹ The original Participating Load design contemplated options for scheduling at local or aggregated levels, however, the overall MRTU design changed to scheduling Load at highly aggregated levels, which created a challenge since the Dispatch of Participating Load is needed at specific physical locations in the ISO's transmission network. A market power concern was raised regarding the originally proposed Participating Load design: if the two principles of (1) overall scheduling of Load at highly aggregated levels and (2) dispatching at specific physical locations were simply combined in a way that would first schedule Load at a highly aggregated level and then re-dispatch it at its specific physical location, an opportunity for abusing the market design would be created through scheduling of fictitious Load that is then "curtailed" at a higher price, back to its actual level.¹² This difference meant that the full Participating Load model could not be adapted in time for implementation in MRTU Release 1, and interim solutions needed to be implemented in MRTU Release 1, as described in the June 26 Issue Paper. However, the original Participating Load model was partially developed during MRTU Release 1's implementation, and will be restored through the MAP initiative as described in this appendix.

Principles for Participating Load Functionality

A guiding principle for this Draft Final Proposal is that the Participating Load model should provide flexibility. At the most basic level, minimum participation for Participating Load means only a simple Energy Bid must be submitted. The ability to provide only a simple Energy Bid can be considered as "Participating Load Lite" if you will, i.e., a way of "participating" in the ISO's market without requiring more complex resource parameters to be submitted along with the energy bid. Yet the model does appropriately provide additional options within the same program design when Participating Loads have needs for additional functionality and resource modeling capability. A Participating Load that simply submits an Energy Bid is not very different from non-Participating Load, and both are valuable resources in the ISO markets. Using additional, optional Bid components, a Participating Load can choose to participate more flexibly in the ISO markets, to the benefit of both the ISO, the market, and the Participating Load. The following discussion outlines several levels of participation that are available to Participating Load in the ISO markets.

¹¹ Terms that use capitalization (e.g., Participating Load) have the meaning stated in Appendix A of the MRTU tariff.

¹² The potential for abusing the market design, and the resulting requirements for its mitigation, were discussed in a working group meeting on October 16, 2007. See <http://www.aiso.com/1c79/1c799d9a40d50.pdf>.

California Independent System Operator

Price-Responsive Demand

Despite its name, a non-Participating Load can participate in the ISO markets by submitting an hourly Energy Bid in the ISO's Day-Ahead Market (DAM) and, most likely, purchasing or selling Energy in the Real-Time Market (RTM) by having actual Demand that differs from its DA Schedule.¹³ The use of an hourly DA Energy Bid, and the opportunity to adjust Demand in RT based on the market price of Energy, constitute price-responsive Demand.¹⁴ The DA Energy Bid for price-responsive Demand may have up to 10 segments, but a Bid may include fewer segments. The price-responsive Demand can indicate in its Energy Bid the price that it is willing to pay for the specified quantities of Energy in the DAM. The geographic areas that are covered by DA Energy Bids by non-Participating Load (including price-responsive Demand that is not Participating Load) are three large Load Aggregation Points (Default LAPs), where the same price applies to all locations within the Default LAPs.¹⁵

Figure A presents an example of an Energy Bid in the DAM for price-responsive Demand. In this example, there is a minimum amount of Demand that is labeled "Minimum Load", which is a "price taker", i.e., the bidder is willing to pay any market clearing price for this amount of Energy, regardless of how high the price is.¹⁶ There are then multiple Bid segments that indicate amounts of Energy that would be purchased at various prices, which extend out to a "Maximum Load", which represents the most Energy that this bidder would purchase at any price, regardless of how low the price is. There is no requirement that the prices of the Energy Bid segments must be greater or less than an expected market clearing price: that is, an Energy Bid segment could either indicate a limited willingness to buy Energy if it costs more than a certain amount, or an interest in buying inexpensive Energy if it is available.

¹³ As an alternative to submitting an Energy Bid that indicates a price that the Load is willing to pay in the Day-Ahead Market, the Load can be "self-scheduled" by submitting only a MW quantity. However, a Self-Schedule is a "price taker" and is not price-responsive from the ISO market perspective.

¹⁴ The term "price-responsive demand" is used to emphasize that it has an important role in the ISO markets, even if it does not become a Participating Load. Generally, "price-responsive demand" is used to describe Demand that responds to varying prices in DA or RT, but this discussion does not mean that "price-responsive demand" constitutes a type of Participating Load program.

¹⁵ The three Default LAPs are the Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric transmission areas.

¹⁶ Any Demand that is scheduled using Transmission Ownership Right (TOR) or Existing Transmission Contract (ETC) capacity must be scheduled as a price taker at a MW level no higher than the Minimum Load. Price-responsive Demand cannot be self-scheduled using a TOR or ETC scheduling priority, because the use of these scheduling priorities inherently excludes the capacity covered by an economic Energy Bid. This applies to Participating Load as well as to non-Participating Load.

California Independent System Operator

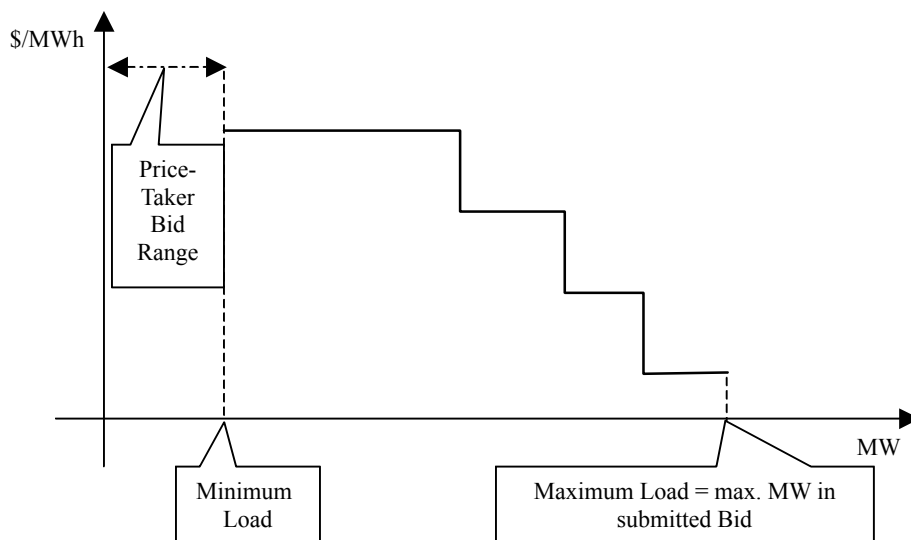


Figure A: Day-Ahead Energy Bid for Price-Responsive Demand

In RTM, the ISO must dispatch enough “Supply” to match the actual Demand, and therefore non-Participating Load, by its very definition, is not dispatchable by the ISO. Thus, non-Participating Load is ineligible to submit RT Energy Bids and participate in the RTM. However, under MRTU, the ISO will publish the current RT cost of Energy (which is the market clearing price for market dispatches issued at the start of a Dispatch Interval, for Energy needed during the Dispatch Interval), in addition to advisory prices 45 minutes before the beginning of each hour, for each 15-minute interval within the hour.¹⁷ This will allow price-responsive Demand to adjust its level of consumption to either avoid paying for avoidable usage during high-cost intervals, or purchase additional Energy during low-cost intervals. The ISO discussed the availability and use of the RTM’s advisory prices in the demand response working group meeting of July 17, 2007. The ISO’s presentation is available at <http://www.caiso.com/1c27/1c27755a43710.pdf>.

There are no penalties in the ISO markets under MAP that limit the ability of price-responsive Demand to select its level of consumption in the DAM or to adjust its consumption in the RTM: (1) whereas section 11.23 of the MRTU tariff provides Uninstructed Deviation Penalties that may be imposed, subject to additional FERC Order, on generators and Interchange transactions with other Balancing Authority Areas, these provisions do not apply to Load or Curtailable Demand, and (2) provisions in MRTU Release 1 to ensure sufficient DA scheduling of Load terminate with the implementation of Convergence Bidding in MAP, which is when the Participating Load functionality described in this document is also implemented.

Because location-specific information is not provided in Bids for non-Participating Load, price-responsive Demand that is non-Participating Load cannot bid to provide AS or capacity for RUC. Instead, through the MRTU Release 1 working group, the ISO established a mechanism for Load Serving Entities to inform the ISO about their operation of demand response programs that use non-Participating Load (whether price-responsive or not), and for the ISO to use this information to adjust its capacity procurement in the RUC process.

¹⁷ The RTM’s Hour-Ahead Scheduling Process (HASP) determines binding hourly Schedules and prices for Intertie resources that cannot participate in RT interval dispatch, and also publishes the dispatch and prices within the ISO that result from HASP, which are non-binding for Non-Participating Loads or for resources that dispatchable in RT interval dispatch.

California Independent System Operator

Participating Load: Basic Functionality

Like other price-responsive Demand, the Energy Bid for a Participating Load may have up to 10 segments, but a Bid may include fewer segments. The Energy Bid is the only required Bid component for a Participating Load. Figure B presents an example of an Energy Bid for Participating Load. As the reader will note, Figure B is nearly indistinguishable from Figure A – that is, there are few differences between the minimum participation of a Participating Load and the activity of price-responsive Demand that is in the ISO markets as a non-Participating Load.

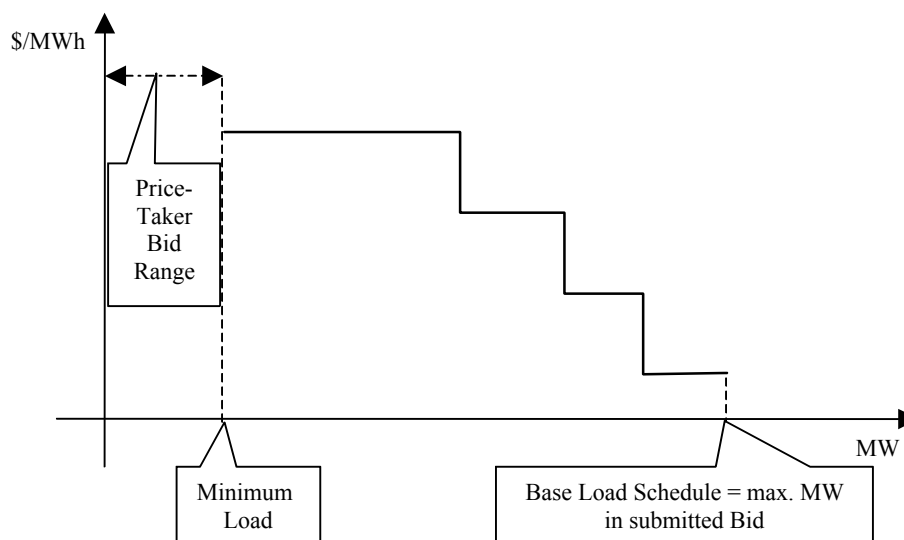


Figure B: Day-Ahead or Real-Time Energy Bid for Participating Load

The differences between the Energy Bids presented in Figures A and B are as follows.

1. The Participating Load model is an integrated resource that uses the same Bid for the original scheduling of Demand and the demand response that is offered for dispatch by the ISO. Participating Load Bids that have been submitted in the DAM may be revised in the RTM, for scheduling in either the Hour-Ahead Scheduling Process¹⁸ or RT interval dispatch (depending primarily on the interval-recording capability of the end-use customer's meter).
2. As required by FERC's September 2006 conditional approval of MRTU and as implemented in MRTU Release 1, Participating Loads will schedule at a nodal level or using custom load aggregation points (Custom LAPs), generally within boundaries such as the "sub-LAPs" used in parts of the current Congestion Revenue Right allocation process, which either coincide with or are within Local Capacity Areas used in Resource

¹⁸ The October 25, 2007, Revised Draft Straw Proposal added an option to the design in the September 25 Draft Straw Proposal to recognize that some retail meters only support hourly metering intervals, by dispatching these Participating Loads in the Hour-Ahead Scheduling Process (HASP), similar to Intertie resources. Dispatch in HASP has some limitations because HASP has a limited look-ahead period for its market optimization, and because Real-Time Bids are only available hour-by-hour. Multi-hour dispatch commitments are not possible in HASP, other than unit commitment of medium-startup-time generation (which generally has a minimum load that is a small fraction of its maximum capacity). For Participating Loads that cannot participate in Real-Time interval dispatch and have minimum curtailment periods, minimum operating time limits will be available in the Day-Ahead Market. This option does include limitations on availability for dispatch, as opposed to minimum duration of dispatch.

California Independent System Operator

Adequacy requirements. The minimum size of a Custom LAP aggregation is 0.1 MW. These levels of aggregation ensure that the ISO can rely on scheduling and dispatching Participating Load demand resources to appropriately manage congestion. Along with ensuring Real-Time reliability of the network, this can also help to ensure the feasibility of scheduling Load using the Default Load Aggregation Points (LAPs). If there are insufficient Bids available for Congestion Management of local network constraints, reductions of Load throughout a Default LAP may be necessary, and the result would be high LMPs in constrained locations since a large amount of Load must be rescheduled to relieve a constraint by a small amount. Having voluntary Energy Bids submitted by Participating Load available to the ISO at the local level reduces the risk of this outcome. The MRTU Release 1 tariff provides that a Participating Load resource is settled entirely at its location's LMP, including Minimum Load that is not included as a price-sensitive portion of the Energy Bid. Because consistent pricing is needed for scheduling and settlement, and because the Participating Load's specific location is identified when its Demand is scheduled, the Participating Load will continue to be settled at its location's LMP.

The example in Figure C illustrates how Participating Load would function with only an Energy Bid curve. In this example, the Participating Load has submitted an Energy Bid with four segments. Following the definition of Base Load in the MRTU Release 1 tariff ("the maximum consumption of a Participating Load as bid in the ISO markets by Scheduling Coordinators"), the highest MW level of the Energy Bid is labeled as the "Base Load". The lowest MW level of the Energy Bid is labeled as the "Minimum Load", and in this case (since there is only an Energy Bid, and no optional Bid components have been used), the Minimum Load is a Self-Schedule like a price-responsive Demand Bid could include. The Participating Load's Schedule would be determined economically within its Bid range, i.e., between its Minimum Load and Base Load. In this example, the fourth Bid segment's price is less than the market clearing price at its location, so its Schedule is at the break between its third and fourth Bid segment. This is shown as a reduction ("Load Curtailment") from its Base Load.¹⁹

¹⁹ Optional Bid components are discussed in subsections below, but one merits discussion at this point. For a Participating Load that participates in Real-Time interval dispatch, a single bid segment could cover a larger MW range than the Participating Load is actually able to change within a 5-minute interval, and price changes between intervals could cause multiple Bid segments to be dispatched. The Participating Load can specify a Load Drop Rate and/or Load Pickup Rate that limits how fast the ISO changes the Participating Load's dispatch. The significance of the ISO's "dispatch" of a Participating Load also needs to be understood. As noted previously, Loads and Curtailable Demand are not subject to the Uninstructed Deviation Penalty, if this provision of the ISO Tariff is activated. The "Dispatch" simply informs the Participating Load of where its optimal operating point is, based on its submitted Bid.

California Independent System Operator

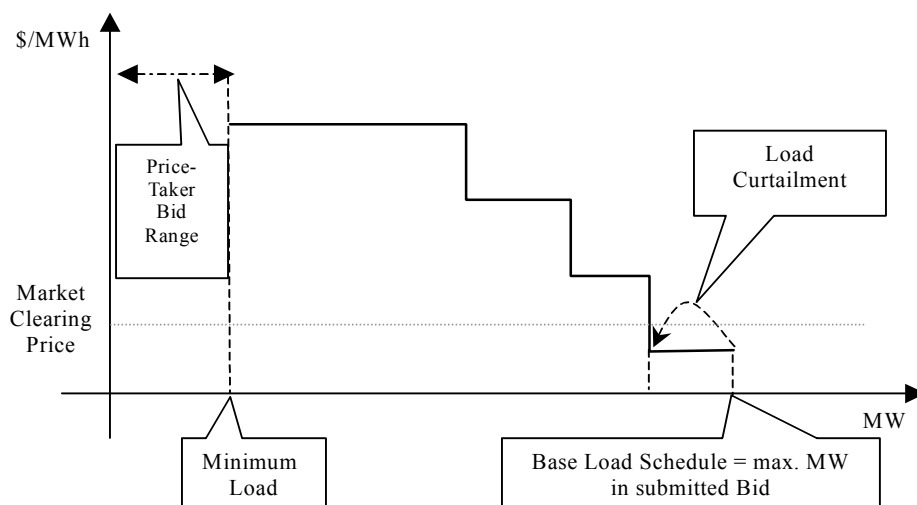


Figure C: Participating Load Energy Bid

The DAM uses hourly scheduling intervals for all loads, including Participating and non-Participating load. In the RTM, the dispatch interval for each Participating Load resource depends on the metering intervals that apply to the relevant end-use customers. Participating Loads that are supported only by hourly metering can participate in RT dispatch using hourly intervals, which are provided in the Hour-Ahead Scheduling Process (HASP) but not in subsequent RT interval dispatch. For these Participating Loads, the process for submitting Settlement Quality Meter Data (SQMD) is the same as for non-Participating Load. For Participating Loads that participate in RT interval dispatch (which uses 5-minute dispatch intervals in MRTU), the SQMD needs to be submitted for 5-minute intervals, but the intervals within the meters may actually be 15-minute intervals. The ISO allows the 15-minute underlying data to be reported by dividing it into the 5-minute reporting intervals required by SQMD. Except as needed to use 5-minute reporting intervals rather than 60-minute reporting intervals, the process for reporting these end-use customers' SQMD would also be the same as for non-Participating Loads.

Technical requirements for participation in Energy markets are limited to providing SQMD that meters Energy usage for the time intervals that match the market prices for the Participating Load's location, and establishment of Custom LAPs that identify the Participating Load's location. The additional metering requirements for Participating Loads, compared to non-Participating Loads, exist because settlement for hourly or sub-hourly prices requires accurate hourly or sub-hourly meter data (not data determined from load profiles). No telemetry is required for Participating Loads to participate in Energy markets (although the availability of telemetry will assist the ISO in maintaining system reliability).²⁰

Participating Load: Optional Capacity Products

The Participating Load model in MAP is a flexible design intended to have comparable functionality to generators.

²⁰ Because no telemetry will be available for some Participating Loads, and because a uniform method of dispatch is desired regardless of whether telemetry is available, the ISO will use the most recent Dispatch as the starting point for future intervals.

California Independent System Operator

In addition to the basic functionality of participating in Energy markets, a Participating Load may optionally participate in the RUC process if it submits a RUC Availability Bid.²¹ The Participating Load model enables demand resources to offer all available Ancillary Service products including Non-Spinning Reserve, Spinning Reserve, and Regulation.²² The eligible amount of AS capacity is the Load reduction that can be delivered within 10 minutes (which requires RT interval dispatch),²³ and requires certification by the ISO to ensure compliance with technical standards established by the Western Electricity Coordinating Council (WECC) and North American Electric Coordinating Council (NERC). Ancillary Services can be simultaneously self-provided for part of the resource's capacity, and bid for any remaining capacity using a single segment for the quantity and price of offered capacity. The RUC Availability Bid indicates the quantity and price of capacity that is offered to meet the ISO's RUC Requirement. A RUC Award does not alter the Participating Load's DA Schedule, but obligates the bidder to offer the RUC capacity for Dispatch in RTM.

Details of the current technical specifications for Non-Spinning Reserve are documented in the ISO's MRTU Participating Load Users Guide, which is available at <http://www.caiso.com/233c/233cd878397d0.pdf>. The technical specifications for provision of Spinning Reserve and Regulation are currently under review in external standard-setting processes at WECC, NERC, and FERC, such as the consideration of a Frequency Response Reserve.²⁴ As these processes progress, the ISO will involve its stakeholders in defining the technical specifications that implement the new standards.

Participating Load: Other Optional Bid Components

In addition to the options stated above, Participating Loads may use several optional Bid components to guide how their capacity is dispatched in the ISO markets, but that are not required components, as listed in the following table: This table compares the options available to Participating Loads and generators to demonstrate that its proposal provides comparable flexibility for scheduling in ISO markets, and does not suggest that Participating Load is the same as generation.

²¹ Participation in RUC may be required for Resource Adequacy (RA) Resources. Participating Loads are anticipated to be use-limited resources in RA portfolios. A RUC Availability Bid of \$0/MWh is used for RA Resources that are required to bid into the ISO markets. However, bidding requirements for such resources are being developed through other regulatory and stakeholder processes, and are beyond the scope of this document. The ISO adjusts the RUC capacity requirement when Load Serving Entities (LSEs) inform the ISO that they are implementing Day-Ahead demand response programs that are not bid into the ISO markets as Participating Load.

²² The ISO will update its Participating Load User Guide as part of its implementation of MRTU and MAP Participating Load functionality, to reflect the applicable requirements. As specific demand response resources demonstrate to the ISO that they satisfy the performance requirements for Ancillary Service products, the ISO will also ensure that applicable WECC and NERC requirements are satisfied.

²³ If the capacity that can be delivered within 10 minutes becomes less than the awarded AS capacity, the SC must notify the ISO using the ISO's outage tracking system. Other limitations on the availability of Participating Loads that occur after the submission of bids to the applicable market are not required to be reported.

²⁴ The current requirements for ancillary services are summarized in the October 2008 Draft Final Proposal for Post-Release 1 MRTU Functionality for Demand Response.

California Independent System Operator

Comparison of Post-Release 1 Participating Load Bid Components with Generation Resource		
Participating Load Resource		Generator Resource
Bid Component	Explanation	
Base Load Schedule	Expected Demand if not curtailed	Base Load
Minimum Load Reduction	Minimum amount of curtailment	Minimum generator output
Minimum Load	Minimum usage	Maximum generator output
Load Reduction Initiation Time	Time required to initiate load reduction	Start-up time
Minimum Load Reduction Time	Minimum time required to operate at reduced load after start of load reduction	Minimum up time
Maximum Load Reduction Time	Maximum time required to operate at reduced load after load reduction initiation	Maximum daily energy limit
Minimum Base Load Time	Minimum time after load restoration, before the next load reduction	Minimum down time
Maximum number of daily load curtailments	Maximum number of curtailments per day	Maximum number of daily starts
Minimum & Maximum Daily Energy Limit	Limits on daily energy from load reduction, if a Curtailable Demand Bid is dispatched	Maximum daily energy limit
Load Drop Rate	Ramp rate for load drop	Ramp up rate
Load Pickup Rate	Ramp rate for load pickup	Ramp down rate
Load Reduction Initiation Cost	Minimum curtailment cost, per curtailment	Start-up cost
Minimum Load Reduction Cost	Minimum curtailment cost, per hour	Minimum load cost

For end-use customers with hourly metering intervals, which will be eligible for dispatch in HASP, all optional Bid components apply in DAM, but the options in RTM are limited to:

- Base Load Schedule
- Minimum Load Reduction
- Minimum Load
- Maximum Load Reduction Time
- Minimum Base Load Time
- Maximum Number of Daily Load Curtailments,
- Maximum Daily Energy Limit
- Load Reduction Initiation Cost
- Minimum Load Reduction Cost

The availability of these Bid components provides Participating Loads with essentially the same flexibility that generators have in the ISO markets to ensure that the ISO's Dispatch recognizes limitations in their availability. The Load Drop Rate and Load Pickup Rate Bid components, which indicate how fast the Participating Load can respond to the ISO's Dispatch instructions, can be pertinent to all Participating Loads. In addition, the Minimum Load and Minimum Load

California Independent System Operator

Reduction can be relevant even if only the Energy Bid is submitted (without AS or RUC Bids). The remaining optional Bid components are meaningful if a Participating Load has a minimum amount of load, which is the “Minimum Load Reduction”, that must be dispatched if any Load Curtailment is used; these are: Base Load Schedule, Minimum Load Reduction, Load Reduction Initiation Time, Minimum & Maximum Load Reduction Time, Minimum & Maximum Daily Energy Limit, Load Reduction Initiation Cost, and Minimum Load Reduction Cost.

The role of these optional Bid components can be seen by comparing Figure D, “Generator Bid”, with Figure E, “Participating Load Bid with Minimum Load Reduction”. The generator’s output is variable within the range of its Energy Bid, but cannot operate below its “Gen Minimum Output”. To reach its minimum output, the generator may incur start-up costs. To operate at its minimum output level, it may incur average costs that are higher than the incremental cost at points within its first Bid segment. The generator may have operating limits including how fast it can start, how long it must run once it starts, and how much Energy it can produce in a given day. The ISO’s market optimization software will take these costs and operating limits into account in determining the optimum Schedules for this and other supply resources. Similarly, the operation of the Participating Load shown in Figure E is variable within the range of its Energy Bid, but if it reduces its Demand below its Base Load, it must reduce by at least its Minimum Load Reduction. It may incur a minimum cost for starting each Load Curtailment, or an hourly cost for its minimum Load Curtailment that exceeds the price at which it can offer additional reductions in Demand. The Participating Load may have operating limits including how fast it can initiate its Load Curtailment, a minimum amount of time that it must remain off-line once it starts a Load Curtailment, a maximum duration of a Load Curtailment, or minimum or maximum amounts of Energy reduction during Load Curtailments. The attributes that the ISO proposes to include as Bid components are listed in the table above, which the ISO believes enables a very flexible array of options for tailoring and managing demand resources.

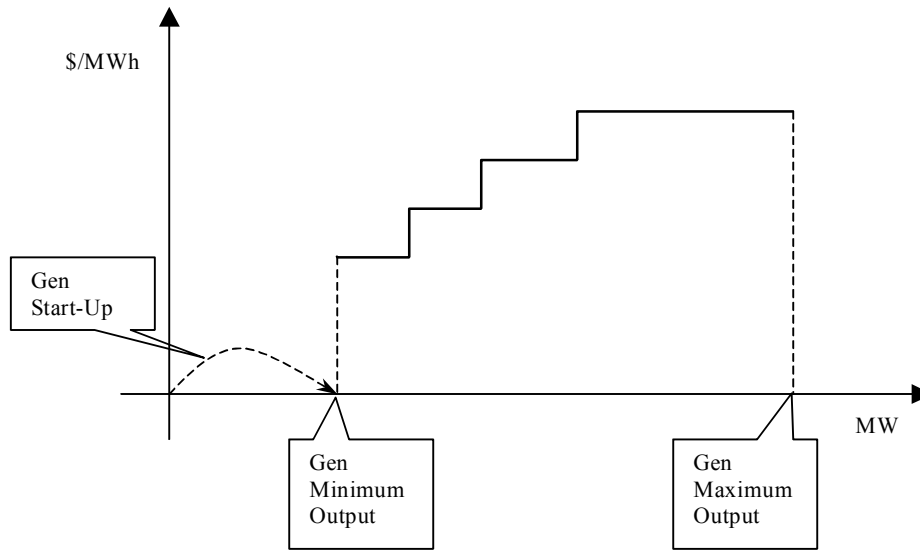


Figure D: Generator Bid

California Independent System Operator

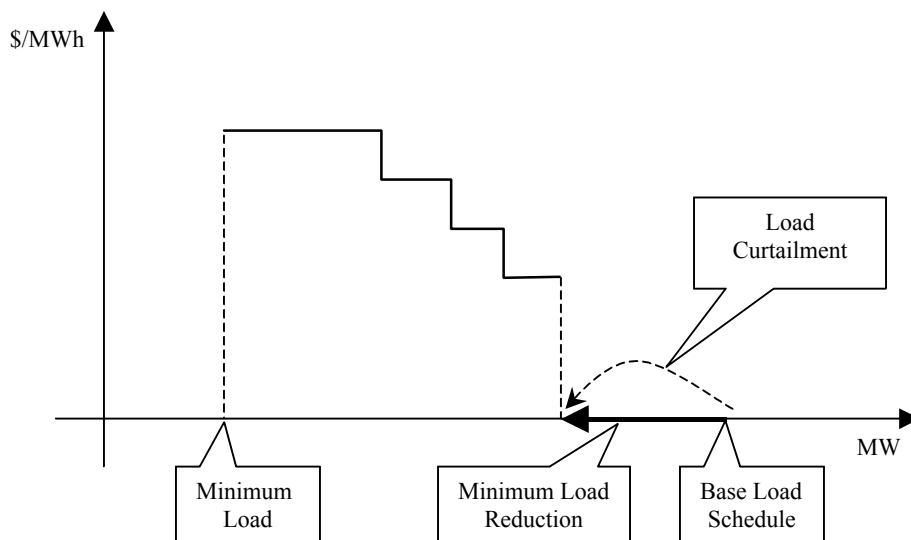


Figure E: Participating Load Bid with Minimum Load Reduction

Needs for Market Power Mitigation and bidding activity rules are more limited for demand response than for other Supply resources. Two existing bidding activity rules in MRTU Release 1 are that the Load Reduction Initiation Cost and Minimum Load Reduction Cost cannot be negative, and these rules are retained. The ISO will include the Market Power Mitigation mechanisms that apply to generation resources, but their activation is subject to conclusions by the ISO's Department of Market Monitoring that this step is appropriate.

Settlements for DA and RT Energy are straight-forward: the DA Schedule is settled at the DA Energy price for its applicable location, and the difference between actual metered Demand and the DA Schedule is settled at the RT Energy price. (The RT Dispatch distinguishes instructed versus uninstructed Energy, but for Participating Loads, these are settled at essentially the same price.) When there are payments in Settlements for actual performance in response to the ISO's Dispatch, the ISO will develop compliance mechanisms to verify that performance. Verification of performance applies to bid cost recovery for Load Reduction Initiation Cost and Minimum Load Reduction Cost, Ancillary Services, and RUC.